

ART. XVII.—*On a Fossil Filamentous Alga and Sponge-Spicules forming Opal Nodules at Richmond River, N.S.W.*

By FREDERICK CHAPMAN, A.L.S., F.R.M.S.

(With Two Text Figures.)

[Read 10th November, 1921.]

Source of Specimens.

The samples of common opal from the diatomaceous deposits of the Richmond River at Tintenbar, New South Wales, now described, were handed over to the National Museum Collection by Mr. R. H. Walcott, Curator of the Technological Museum, Melbourne. They were received by Mr. Walcott from Mr. G. N. Milne, of the Salvation Army, at Bayswater, on the 18th of December, 1919.

In response to Mr. Walcott's desire to know something of the microscopic nature of these samples, I took thin slices from two of the pieces, which gave different results; in the one case a spicule-rock being revealed, originating from freshwater sponges, and in the other the matted thalli of a confervoid freshwater weed, probably of the genus *Cladophora*, and now silicified.

Literary Notes on the Deposit.

Professor Liversidge, writing on the siliceous deposits from the Richmond River, New South Wales,¹ refers to this rock as resembling "the deposits thrown down by hot springs or geysers." He records the presence of wood opal and remains of ferns (*Pteris*) and seeds, one of the latter being named by von Mueller, *Liversidgea oxyspora*,² to which is also referred a leaf fragment.

J. Milne Curran, in writing on precious stones in New South Wales,³ on p. 258 of the reference quoted, says, "I have more than once received specimens of diatomite from the Richmond River, which were in part converted into a true opal."

1. Journ. and Proc. R. Soc. N.S. Wales, vol. X. (1876), 1877, pp. 237-240.

2. Loc. cit., p. 239, plate.

3. Journ. and Proc. R. Soc., N.S. Wales, vol. XXX (1896), 1897.

The most important contribution on the diatom deposit of the Richmond River is that by Messrs. G. W. Card and W. S. Dun.⁴ A copious quotation bearing on the present work is as follows:—

“Wyrallah.—The deposits on the Richmond River appear to be typically developed at Wyrallah, nine miles from Lismore. Here there seems to be a number of scattered deposits on either side of the Richmond River. They are surrounded and overlain by scoriaceous basalt, and occur in depressions in the same rock. Probably large areas of the diatomaceous earth have been washed away. It has been stated at various times that considerable thicknesses of the earth exist in private lands, but this requires confirmation. The physical character of the diatomaceous earth from these deposits is peculiar. It is hard and stony, requiring considerable pressure to crush it, and it is of a dirty white colour. The percentage of silica is high—over 90 per cent., and the lower portion of the deposit merges into a band of yellowish common opal, about a foot thick. Pieces of the opaline rock are marginally earthy, due probably to the removal by solution of the secondary silica, as in the case of chalk flints. The rock is isotropic, and marked with parallel bands, coloured by splashes of yellow and brown.⁵ With a high magnifying power the base is seen to be made up of hazy wisps and shreds, and numerous indistinct fragments of *Melosira*. This has been remarked on by the Rev. J. Milne Curran.”⁶

Some interesting “Notes on a Plant-bearing Common Black Opal from Tweed Heads, N.S.W.” have been published by Prof. E. W. Skeats. The opal occurs associated with basalt flows, and, although the age of the basalt is left open by Prof. Skeats, yet the occurrence of the freshwater algae in the opal at any rate points to similar conditions of deposition that we infer from the opal of the Richmond River now under discussion. It will be here appropriate to quote part of the remarks of Prof. Ewart upon the structures found in the opal, recorded on p. 21 of Prof. Skeats’ paper: “Some of the structures appeared to represent sections of fresh-water algae, others of various plants, including the spore of a fungus, a transverse section of a leaf, and, possibly, a section of a small petiole.”

4. Rec. Geol. Surv. N.S. Wales, vol. V., pt. 3, 1897, pp. 143 and 144.

5. This description applies to the present specimens.

6. “This” refers to the opal, and not to its contents, as a reference to Mr. Curran’s paper will show.

7. Proc. Roy. Soc., Queensland, vol. XXVI., 1914, pp. 18-22, pls. I. and II.

Description of Thallophyte.

The appearance of this organism in a thin section under a moderate magnification (1 inch obj.) is that of a matted, filamentous weed, reminding one of the threadlike conferva of lakes and streams. The filaments are usually cylindrical, and

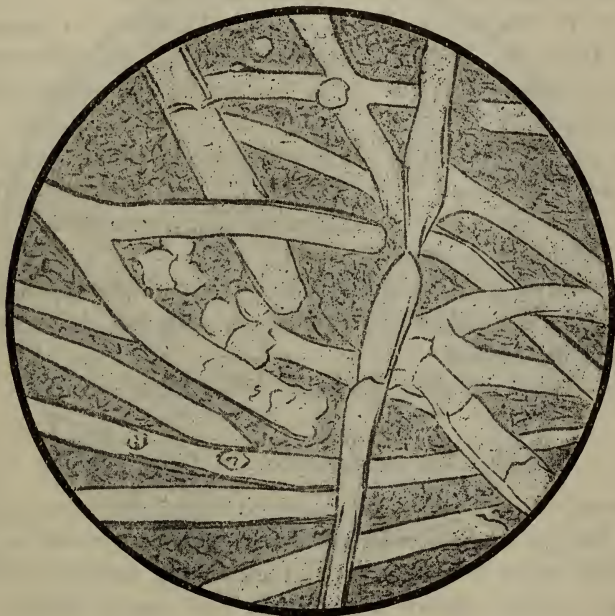


Fig. 1 *Cladophora richmondiensis*, sp. nov.

constricted at the nodes or partitions. The partitions are spaced at fairly long intervals, varying from about three to six times the diameter of the filament. The cell-walls show a well marked outline of the exterior and interior, which character distinguishes them at once from any spicular body, in which there is a strong surface refraction.

Small rounded bodies in aggregates are seen in the matrix, which may be referable to tetraspores. The average diameter of the cells of the thallus measure 46 μ .

That this fossil form is of the confervoid type of cell-structure, and not referable to the blue-green algae, is very clear from the distinctness of the cell-walls, which are sharply outlined and not hazy as in the encrusted cells of the *Cyanophyceae*.

The occurrence of this fossil confervoid is of especial interest on account of the rarity of fossil remains of this character. Impressions of confervoid-like structures in rocks were named *Confervites* by Brongniart in 1828.

Bornemann also described a Cambrian fossil from Sardinia, to which he gave the name of *Confervites chantransioides*; the filaments of this fossil have a diameter of 6-7 μ .⁸

Dr. C. D. Walcott has lately described a genus of algae, *Marpolia*,⁹ from the Middle Cambrian shale of the Burgess Pass Quarry, British Columbia. This form closely resembles the habit of growth in *Cladophora*, though no actual structure of the thallus was determinable. It is relatively larger in size than the form here described from the opal. Dr. Walcott refers the genus *Marpolia* to the *Cyanophyceae*, but a comparison is made with *Cladophora* (*Chlorophyceae*).

Some forms of the *Codiaceae* are also filamentous and branching, and are not unknown in fossil deposits, but these appear to be of marine habitat.

Age.—Late Cainozoic; probably Pleistocene.

Description of Spicules in Opal (Fig. 2).

The majority of the spicules found in one specimen examined are of the typical *Spongilla* type, being straight, curved or slender fusiform; some are nearly cylindrical and pointed at the extremities, whilst others are arcuate and much thicker in the middle. A few extremely slender needle-like forms are present. The surfaces are apparently all more or less spinulose. These appear to belong to the genus *Spongilla*, whilst a few smooth forms may belong to *Meyenia*. Very few traces of amphidiscs occur, but those seen are of the type of *Spongilla capewelli*, a species named by Bowerbank from specimens occurring at Lake Hindmarsh, Victoria.¹⁰ A portion of what appears to be the head of a birotulate spicule, with a denticulate margin shows some resemblance to the form described by Prof. Haswell as *Meyenia ramsayi*.¹¹

Regarding a similar diatomaceous and sponge spicular deposit, from the Warrumbungle Mountains, Mr. R. Etheridge (junr.)

8. Kals. Leop.-Carol Deutsche Akad. Naturforscher, vol. LI., 1887.

9. Smithsonian Misc. Coll. vol. LXVII., No. 5, 1919 p. 233.

10. Proc. Zool. Soc. Lond., 1863, p. 447, pl. XXXVIII., fig. 3.

11. Proc. Linn. Soc. N.S. Wales, vol. VII., 1883, p. 210.

recognised in it¹² *Spongilla* sp., and this was confirmed by Dr. Hinde, who also determined the presence of amphidiscs, belonging the genus *Meyenia*.¹³ The diatomaceous deposits of the War-rumbungle Mountains are, however, of greater age than those



Fig. 2 Spicules in Opal.

described above, for Prof. David has shown¹⁴ that they are inter-bedded with a trachytic tuff, which has yielded leaves of *Cinnamomum Leichhardtii*, Ett.

12. Ann. Rep. Dept. Mines, N.S. Wales for 1887 (1888), pp. 165, 166.

13. See Card and Dun, Rec. Geol. Surv. N.S. Wales, vol. V., 1897, p. 148.

14. Proc. Linn. Soc. N.S. Wales, vol. XXI., 1896, pt. 2, p. 265.